

-23-

## CLAIMS

1. A rotary compressor, comprising:

2 a shaft rotatable about an axis;

4 at least one compressor wheel mounted on said shaft for  
rotation therewith and having an inlet end of relatively small diameter and  
a radial discharge end of relatively large diameter;

6 a nominally donut-shaped intercooling heat exchanger centered  
about said shaft and adjacent said turbine wheel, said heat exchanger  
8 having heat exchange fluid flow paths in heat exchange relation with each  
other including a compressed gas flow path and a coolant flow path, said  
10 coolant flow path being bounded in part by a wall of a diameter at least as  
great as said relatively large diameter;

12 a housing for said compressor wheel and said heat exchanger  
and together with said wall defining a compressed gas directing space  
14 extending from said radial discharge end to an entrance to said compressed  
gas flow path; and

16 a plurality of flow straightening vanes thermally coupled to  
said wall and extending across said compressed gas directing space so that  
18 heat in said compressed gas may be rejected to said vanes and then to  
coolant in said coolant flow path.

-24-

2. The rotary compressor of claim 1 wherein said wall is generally radially extending and on an end of said heat exchanger closest to said compressor wheel and includes a section of greater diameter than said relatively large diameter, said vanes extending generally radially and being aligned with said section.

3. The rotary compressor of claim 2 wherein said vanes are mounted on said wall at said section.

4. The rotary compressor of claim 2 wherein said vanes are thermally coupled to said section of said wall by metallurgical bonding.

5. The rotary compressor of claim 1 wherein said heat exchanger includes plural pairs of plates, the plates of each pair being centrally apertured and having a generally circular outer axially directed peripheral wall and a generally circular inner axially directed peripheral wall with a generally flat area extending between said peripheral walls and radially directed flanges on each peripheral wall axially spaced from the flat area of the corresponding plate, the flanges on the plates of each pair being secured and sealed together to define a flattened nominally donut-shaped unit defining annular flow parts of said coolant flow path, said pairs of plates being alternately stacked with fin structures extending between radially inner and outer peripheral walls to define radial flow parts of said compressed gas flow paths, there being one of said units on each axial end of said heat exchanger with the flat area of one of the plates of said one unit defining said wall.

-25-

6. The rotary compressor of claim 5 wherein each fin structure is a circular serpentine fin having circumferentially alternating crests and valleys with the crests thereof in heat exchange thermal contact with units between which each fin is located.

7. The rotary compressor of claim 6 wherein each of said units includes a radially outwardly directed tab with the tab of each unit being aligned with the tabs of each other unit throughout the stack, the tabs of each unit further extending radially outwardly past the serpentine fins and axially into sealed engagement with each other, two apertures in each tab establishing fluid communication between the units in the stack and a flow blocking portion extending across the flat areas of each plate of each unit between the radially inner peripheral walls and the radially outer wall of the tab and at a location between the two apertures of each tab.

8. A rotary compressor, comprising:

a shaft rotatable about an axis;

at least one compressor wheel mounted on said shaft for rotation therewith and having an inlet end of relatively small diameter and a radial discharge end of relatively large diameter;

a nominally donut-shaped intercooling heat exchanger centered about said shaft and adjacent said turbine wheel, said heat exchanger having heat exchange fluid flow paths in heat exchange relation with each other including a compressed gas flow path and a coolant flow path, said coolant flow path being bounded in part by a wall of a diameter at least as

-26-

great as said relatively large diameter, said heat exchanger including plural pairs of plates, the plates of each pair being centrally apertured and having a generally circular outer axially directed peripheral wall and a generally circular inner axially directed peripheral wall with a generally flat area extending between said peripheral walls, and radially directed flanges on each peripheral wall axially spaced from the flat area of the corresponding plate, the flanges on the plates of each pair being secured and sealed together to define a flattened, nominally donut-shaped unit defining annular flow parts of said coolant flow path, said pairs of plates being alternately stacked with fin structures extending between said radially inner and outer peripheral walls defining radial flow parts of said compressed gas flow path, there being one of said units on each axial end of said heat exchanger with the flat area of one of the plates of said unit defining said wall, each said fin structure being a circular serpentine fin having circumferentially alternating crests and valleys with the crests thereof in heat exchange thermal contact with units between which each fin is located, each of said units further including inlet and outlet ports with the inlet and outlet ports of each unit being aligned with and sealed to the inlet and outlet ports of each adjacent unit in the stack;

inlet and outlet fixtures mounted and sealed to the inlet and outlet of one of said units; and

a housing for said compressor wheel and said heat exchanger and together with said wall defining a compressed air directing space extending from said radial discharge end to an entrance to said compressed air path.

-27-

9. The rotary compressor of claim 8 including an additional  
one of said compressor wheels in axially spaced relation on said shaft to  
said at least one compressor wheel and there are two of said walls and  
axially spaced from each other, one adjacent said discharge end of said  
least one compressor wheel and one adjacent the discharge end of said  
additional compressor wheel.

10. The rotary compressor of claim 9 further including first  
and second sets of flow straightening vanes, one set being mounted on one  
of said walls in thermally coupled relation therewith and another set being  
mounted on the other of said walls in thermally coupled relation therewith.

11. The rotary compressor of claim 9 wherein there are ser-  
pentine fins on each of said two walls, one adjacent the discharge end of  
each of said compressor wheels.

12. The rotary compressor of claim 8 wherein each of said  
units includes a radially outwardly directed tab with the tab of each unit  
being aligned with the tabs of the other units throughout said stack, the tab  
of each further extending radially outwardly past the serpentine fins, said  
inlet and outlet ports including aligned apertures in said tabs.

-28-

13. The rotary compressor of claim 12 wherein said ports  
2 further include axially directed collars surrounding said aligned apertures  
and engaging and sealed to collars of the adjacent tabs and establishing  
4 fluid communication between the apertures, and thus the units, in the  
stack, and flow blocking partition extending across flat areas of each plate  
6 of each unit between the radially inner and outer peripheral walls thereof at  
a location between said inlet ports and said outlet ports.

14. The rotary compressor of claim 12 where each said tab  
2 extends axially into sealed engagement with adjacent tabs about said aper-  
tures.

15. The rotary compressor of claim 14 wherein each said tab  
2 extends axially into said sealed engagement by means of axially directed  
collars surrounding said aligned apertures.

16. The rotary compressor of claim 15 wherein adjacent  
2 sealed collars telescope into one another.

17. The rotary compressor of claim 12 wherein each said unit  
2 includes two of said tabs, said two tabs being circumferentially spaced  
about said circular outer axially directed peripheral wall, and said inlet parts  
4 are in one of the tabs of each said unit and said outlet ports are in the other  
of the tabs of each said unit.

-29-

18. The rotary compressor of claim 8 further including at  
least one circumferential flow director within each said unit at a location  
radially inward of said outer axially directed peripheral wall and radially  
outward of said inner axially directed peripheral wall, said outlet ports being  
in fluid communication with a first space between one of said peripheral  
walls and said flow director and said inlet ports being in fluid communica-  
tion with a second space between the other of said peripheral walls and  
said flow director.

19. The rotary compressor of claim 18 further including a port  
in each of said flow directors at a location remote from said inlet and outlet  
ports establishing fluid communication between said first and second  
spaces.

20. A rotary compressor, comprising:  
a shaft rotatable about an axis;  
at least one compressor wheel mounted on said shaft for  
rotation therewith and having an inlet end of relatively small diameter and  
a radial discharge end of relatively large diameter;  
a nominally donut-shaped intercooling heat exchanger centered  
about said shaft and adjacent said turbine wheel, said heat exchanger  
having heat exchange fluid flow paths in heat exchange relation with each  
other including a compressed gas flow path and a coolant flow path, said  
coolant flow path being bounded in part by a wall of a diameter at least as  
great as said relatively large diameter, said heat exchanger including plural

-30-

12 pairs of plates, the plates of each pair being centrally apertured and having  
a generally circular outer axially directed peripheral wall and a generally  
14 circular inner axially directed peripheral wall with a generally flat area ex-  
tending between said peripheral walls, and radially directed flanges on each  
16 peripheral wall axially spaced from the flat area of the corresponding plate,  
the flanges on the plates of each pair being secured and sealed together to  
18 define a flattened, nominally donut-shaped unit defining annular flow parts  
of said coolant flow path, said pairs of plates being alternately stacked  
20 with fin structures extending between said radially inner and outer periph-  
eral walls defining radial flow parts of said compressed gas flow path, there  
22 being one of said units on each axial end of said heat exchanger with the  
flat area of one of the plates of said unit defining said wall, each said fin  
24 structure being a circular serpentine fin having circumferentially alternating  
crests and valleys with the crests thereof in heat exchange thermal contact  
26 with units between which each fin is located, each of said units including  
aligned inlet and outlet ports for the annular flow parts of said coolant flow  
28 path, said inlet and outlet ports including aligned apertures in said plates.

21. The rotary compressor of claim 20 wherein said apertures  
2 are surrounded by axially directed collars, aligned ones of said collars being  
sealed to one another.

22. The rotary compressor of claim 21 wherein said collars  
2 are integral with their respective plates and telescope into one another.



-31-

2 23. The rotary compressor of claim 22 further including flow  
directors in each of said units separating said inlet and outlet ports to cause  
flow through said annular flow parts.

2 24. The rotary compressor of claim 23 wherein said flow  
directors are circumferentially directed.

2 25. The rotary compressor of claim 23 wherein said flow  
directors are radially directed.

2 26. The rotary compressor of claim 20 wherein one of said  
units additionally includes a radially directed tab and inlet and outlet fixture  
mounted to said tab and being respectively in fluid communication with the  
4 inlet and outlet ports in said one unit.

2 27. The rotary compressor of claim 26 wherein said one unit  
has an annular flow part of greater cross-sectional area than the annular  
flow part of the other of said units.